

Observed occupational radiofrequency and microwave
radiation exposures during surveys around a few scientific,
industrial and medical sources

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Abstract

This paper summarizes the results of a few near electric field safety surveys conducted around radiofrequency and microwave radiation (RFMR) generating equipment. Field levels observed under actual working conditions have been graded into three categories. In the first category are the diathermy units. In the second, are inductively coupled plasma atomic emission spectrometers, crystal growing furnaces and feeder lines of the broadcasting transmitters. In the third category are surveillance radars and TV transmitters. Fields around plastic sealing machines vary widely.

Introduction

During the last few years there has been growing realization that occupational exposure to RF radiation in the lower frequency range, from health consideration, is of the same importance as that from MW. In this paper the observed electric field strengths in the vicinity of equipment have been graded and interpreted in the light of existing exposure limits¹. The instrument used for measurement of electric field in RF and MW region is model 8611 radiation monitor of Narda make working in conjunction with probes 8662B and 8621C.

Main observations and Discussion

Salient observations on the electric field strengths observed around the equipment along with the frequency, power and distance of measurement are given in Table 1. Bathymetric representation of the field generated by operation of two furnaces in a single hall has been plotted as given in figure 1.

Below operating frequencies of 10 MHz electric and magnetic fields are required to be measured separately¹. In this study, however, measurements were confined to electric field strengths alone in all the cases². The fields observed in case of diathermy-unit surveys³ have been listed according to the part of the body being treated. It is seen that field as high as 776 V/m has been observed at a distance of 10 cm from the applicator plates. The farthest spot with appreciable field of 168 V/m is at 30 cm in the case of knee treatment. Occupational exposure limit for the 10-400 MHz slab which is relevant for the units operating at 27.12 MHz is 61 V/m. The observed fields are high when compared with a value of 17

mW/cm² at a distance of 15 cm reported elsewhere⁴.

It is clear from the bathymetric representation of the field around two crystal growing furnaces in a single working area that fields created by individual operation fall rather sharply and do not superimpose each other. In spite of the fact that power dissipated in one of the units is 2.5 times that in the other, the highest observed electric field strength is of the same level.

Concluding Remarks

It is concluded from the above study that high fields in most cases are confined to distances close to heating electrodes, radiating element or applicator plates. Awareness about high fields in close proximity and the knowledge that unnecessary exposures are to be avoided would go a long way in reducing exposure. When an instrument is under repair, inadequately shielded and inappropriately terminated, it can be a source of high leakage⁵. It is imperative that a programme of safety studies and survey around equipment generating RFMR be kept alive.

References

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Table 1. Observed electric field strength around a few medical, scientific and industrial sources of radiofrequency and microwave radiation

MEDICAL

Source of rf radiation : Diathermy unit
 Operating frequency : 27.12 MHz
 Power of unit : 500 W

Part of body	No. of obs.	Average field strength (V/m)				
		Distance from applicator plate (cm)				
		10	15	20	25	30
Back	16	776	598	238	194	
Neck	14	739	434	260	238	
shoulder	16	658	442	-	-	
knee	19	598	455	307	434	168

SCIENTIFIC

Source of rf radiation	operating frequency (MHz)	power of unit (kW)	Dist. from source (cm)	field strength (V/m)	remarks
ICP Units	27.12	2	5 5	19 307	Improperly terminated cable
Crystal growing furnace	0.45	10	20 60 90 180	868 238 194 87	Distances are from the bend position of the feeder line between osc. and furnace
			5 20 40	751 238 162	Distances are from the feeder line near the furnace
Crystal growing furnace	0.38	25	30 60 120	672 238 27	Above the feeder line
			5 50 100 150	823 162 31 19	Readings taken at the height of feeder line

(Table 1. Continued)

Source of rf radiation	operating frequency (MHz)	power of unit (kW)	Dist. from source (cm)	field strength (V/m)	remarks
Plastic sealing unit	30.00	1	5 10	162 90	Distances are from the electrodes
	30.00	1	10	>868	below RF cable to electrode
INDUSTRIAL					
Broadcast transmitters	11.83	100	1100 6700 45000	306 123 72	Distances are from the antenna
T.V. transmitters	62-67	10	40000	negligible	Antenna height 330 meters
Radar units	2-6 (GHz)	2 (Av)	10000	negligible	Pulsed beam, 1.6 MW peak power

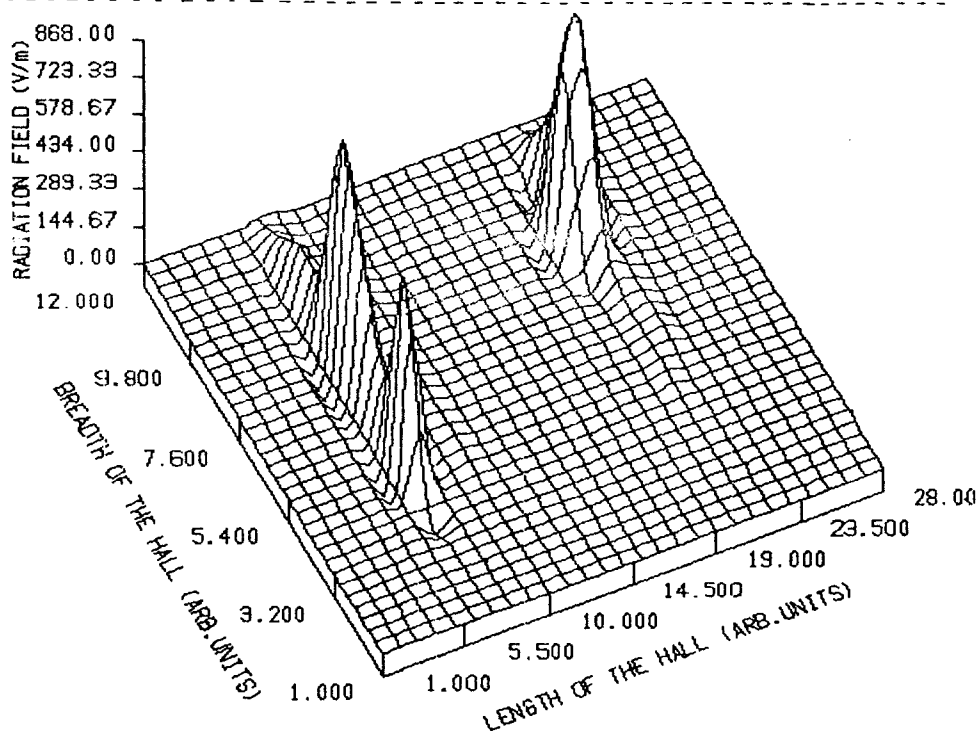


FIG.1. RADIO FREQUENCY FIELD AROUND TWO CRYSTAL GROWING FURNACES HAVING 10 AND 25 kW POWER. ARBITRARY UNIT IS 0.5m.